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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/535,420	LI ET AL.	
	Examiner	Art Unit	
	James Pontius	2483	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 August 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11 and 13-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11 and 13-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date *08/02/2010*.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/02/2010 has been entered.

Response to Arguments

2. Applicant's arguments, filed 08/02/2010, with respect to the 35 U.S.C. 102 and 103 rejections of claims 1-11 and 13-24 have been fully considered but they are not persuasive.

3. On page 23 of Applicant's Arguments, Applicant argues that Subramaniyan fails to disclose:

a) determining, using one or more computer processing systems, a motion estimation representative of the global motion between the particular frame and a first preceding or succeeding frame of the inter-frame encoded video sequence, on the basis

of motion vectors directly between the particular frame and the first preceding or succeeding frame;

b) determining, using the one or more computer processing systems, one or more further motion estimations representative of the global motion between the particular frame and the first preceding or succeeding frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames; and

c) selecting, using the one or more computer processing systems, one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the particular frame;

Examiner respectfully disagrees.

As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame”. Thus Subramaniyan is able to determine a motion estimation representative of the global motion between the particular frame and another frame on the basis of an average of motion vectors therebetween, which satisfies claim limitation (a). This is reaffirmed in [0035] of Subramaniyan, which states that “the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame”.

As stated in [0034] of Subramaniyan, “further motion vector predictors can be determined based on the result of motion estimation done for the same macroblock, but on a different previously coded frame”. Thus Subramaniyan discloses further motion vector predictors based on a previous frame that is different from the previous frame initially used. Using these further motion vectors predictors in light of how global motion vectors in Subramaniyan are determined, Subramaniyan is capable of determining a further motion estimation representative of the global motion between the particular frame and another frame at least partially on the basis of an average of motion vectors between the particular frame and one or more different other frames, which satisfies limitation (b). This is reaffirmed in [0026] of Subramaniyan, which states that “motion estimation is computed for blocks of image data from a current image frame using one or more previously processed image frames”.

As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame for which a difference metric was below a certain threshold THRESH1”. Since the final motion vectors are subject to a difference metric and the final motion vectors are used to form the global motion vector, the global motion vector is subject to a predetermined criterion. By determining global motion in such a manner, global motion is contemporaneously selected upon its determination. Thus Subramaniyan is capable of selecting one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame, which

satisfies limitation (c). This is reaffirmed in [0035] of Subramaniyan, which states that "the motion estimation circuit 110 can determine the global motion vector by calculating a difference metric for each of final motion vectors in a previous frame, comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold, and determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold".

4. In the middle of page 24 of Applicant's Arguments, Applicant states that "[i]n part (c) of claim 1, the separate estimates are combined to arrive at single estimate of global motion between the different frames." On the last line of page 25 of Applicant's Arguments, Applicant similarly states that "the single vector characterizing global motion is derived from a combination of two independently calculated global motion values." Examiner notes that while this may be true of Applicant's invention as disclosed in Applicant's specification, this type of "combination" does not appear in Applicant's independent claims.

5. On page 26 of Applicant's Arguments, Applicant argues that "Subramaniyan uses predictor motion vectors to match pixel blocks (macroblocks) in preparation for <u>encoding</u> an image" and that "Subramaniyan is directed to a video encoder system", while "[i]n the invention of claim 1, motion estimation is applied to an <u>already encod**ed**</u> image in order to allow the plurality of vectors to be replaced by a single vector, e.g. for the purposes of

image registration". In support of this argument, Applicant states that "Subramaniyan thus describes processing raw pixel data in an unencoded frame with the obvious intent of encoding the frame in the video encoder. As such, Subramaniyan could be seen as a precursor stage to the method of the invention of claim 1, in that Subramaniyan describes generating an encoded signal of the type that is processed by the present invention. However, since Subramaniyan could be seen as a precursor stage to the method of the invention of claim 1, Subramaniyan clearly fails to disclose features (a)-(c) of claim 1. The invention of claim 1 deals with a video signal that is already encoded, as stated by the claim 1." Examiner respectfully disagrees with such a narrow interpretation of Subramaniyan.

Examiner agrees with Applicant that "Subramaniyan uses predictor motion vectors to match pixel blocks (macroblocks) in preparation for <u>encoding</u> an image" and that "the invention of claim 1, motion estimation is applied to an <u>already encod**ed**</u> image in order to allow the plurality of vectors to be replaced by a single vector, e.g. for the purposes of image registration". However, the fact that Subramaniyan can use global motion as a motion vector predictor in preparation for coding future frames does not by itself negate the fact that, in Subramaniyan, global motion is calculated in a manner consistent with Applicant's claim language. This simply indicates that, in Subramaniyan, global motion can be used for motion estimation of subsequent frames. There is nothing in Applicant's claim language which prevents global motion from being used as a motion vector predictor in the motion estimation of subsequent frames. The global motion in Subramaniyan can be implemented for a variety of uses and still disclose

Applicant’s claim limitations (a)-(c) so long as the Subramaniyan global motion is calculated in a manner consistent with Applicant's claim language.

Applicant argues that since Subramaniyan processes raw pixel data to generate an encoded signal, Subramaniyan can only be viewed as a precursor to Applicant's claims. Applicant continues this logic and argues that because Subramaniyan can only be viewed as a precursor to Applicant's claims, Subramaniyan cannot disclose claim limitations (a)-(c) which is for an already encoded signal.

From a general standpoint, Applicant is correct that Subramaniyan processes a raw pixel data input to generate an encoded signal output. However, in between this raw pixel data being input and an encoded signal being output, Subramaniyan discloses using an inter-frame encoded signal to generate global motion. As stated in [0035] of Subramaniyan, “the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame”. By using motion vectors to calculate global motion, raw pixel data is not used to calculate global motion. Raw pixel data does not contain motion vectors. The use of motion vectors between frames indicates that these frames have been previously inter-frame encoded. This is because inter-frame encoded data by definition includes at least some indication of similarities and differences between frames, such as motion vectors and/or residual data. It is noted that such a definition of inter-frame encoded data is consistent with Applicant’s specification, which defines inter-frame encoding to be the production of “motion vectors indicative of the general motion of a number of macroblocks which make up a frame with respect to a preceding or succeeding frame”, as stated in page

29, line 3-7, of Applicant's specification. Thus, by using motion vectors to calculate global motion, as in Subramaniyan, previously inter-frame encoded video data is used to calculate global motion.

6. In the top of page 27 of Applicant's Arguments, Applicant states that "[a]s indicated at paragraph [0030] [of Subramaniyan], one option for the predictor motion vectors used in Subramaniyan is an estimate of global motion for a previous frame (i.e., not for the current frame, as in the invention of claim 1)". Examiner notes that while this may be true of Applicant's invention as disclosed in Applicant's specification, use of a "current frame" does not appear in Applicant's independent claims.

7. In the middle of page 27 of Applicant's Arguments, Applicant argues that "[a]s with the other predictor motion vectors, the estimated global motion vector [of Subramaniyan] is not used to represent global motion of the current frame, but to indicate where in the current frame to start a search for the best individual macroblock motion vectors with which to encode the current frame". Examiner respectfully disagrees with such a narrow in interpretation of Subramaniyan, as shown above. Subsequent use of global motion in Subramaniyan does not negate creation of global motion in a certain manner, as shown above. Furthermore, the global motion of Subramaniyan is calculated as representative of a frame based on motion vectors between that frame and another frame, as shown above.

Claim Objections

8. Claims 14 and 19 are objected to because of the following informalities: Limitations (i) recite “an preceding or succeeding frame”, which is grammatically incorrect. Appropriate correction is required.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 1, 13-14 and 19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. Claims 1 and 13 recite a “first preceding or succeeding frame” three times in each claim. It is unclear if the word “first" applies only to a “preceding” frame or if the word “first” applies to both a “preceding” frame as well as a “succeeding” frame. Examination was conducted as if the word “first” applies to both a “preceding” frame as well as a “succeeding” frame.

12. Claims 1, 13-14 and 19 recite “the particular frame” and a “preceding or succeeding frame of the inter-frame encoded video sequence”. It is unclear if only the “preceding or succeeding frame” are “of the inter-frame encoded video sequence” or if

both “the particular frame” as well as the “preceding or succeeding frame” are “of the inter-frame encoded video sequence”. Examination was conducted as if both “the particular frame” as well as “a first preceding or succeeding frame” are “of the inter-frame encoded video sequence”

13. Claims 1 and 13 recite the limitation “the image” in the last paragraph of each claim. There is insufficient antecedent basis for this limitation in the claims.

Claim Rejections - 35 USC § 102

14. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

15. Claims 14-17 are rejected under 35 U.S.C. 102(e) as being anticipated by Subramaniyan et al. (US Patent Application Publication # 2004/0028134 A1).

16. Regarding claim 14,

Subramaniyan discloses:

A system for global motion estimation between frames of a motion-compensated inter-frame encoded video sequence, the system comprising:

video processing means arranged in use to:

i) determine a motion estimation representative of the global motion directly between the particular frame and preceding or succeeding frame of the inter-frame encoded video sequence on the basis of motion vectors therebetween (As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame”. Thus Subramaniyan is able to determine a motion estimation representative of the global motion between the particular frame and another frame on the basis of an average of motion vectors therebetween, which satisfies claim limitation (a). This is reaffirmed in [0035] of Subramaniyan, which states that “the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame”.);

ii) determine one or more further motion estimations representative of the global motion between the particular frame and the preceding or succeeding frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames (As stated in [0034] of Subramaniyan, “further motion vector predictors can be determined based on the result of motion estimation done for the same macroblock, but on a different previously coded frame”. Thus Subramaniyan discloses further motion

vector predictors based on a previous frame that is different from the previous frame initially used. Using these further motion vectors predictors in light of how global motion vectors in Subramaniyan are determined, Subramaniyan is capable of determining a further motion estimation representative of the global motion between the particular frame and another frame at least partially on the basis of an average of motion vectors between the particular frame and one or more different other frames, which satisfies limitation (b). This is reaffirmed in [0026] of Subramaniyan, which states that "motion estimation is computed for blocks of image data from a current image frame using one or more previously processed image frames".); and

a motion estimation selector means arranged in use to select one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame (As stated in [0030] of Subramaniyan, the "global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame for which a difference metric was below a certain threshold THRESH1". Since the final motion vectors are subject to a difference metric and the final motion vectors are used to form the global motion vector, the global motion vector is subject to a predetermined criterion. By determining global motion in such a manner, global motion is contemporaneously selected upon its determination. Thus Subramaniyan is capable of selecting one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame, which satisfies limitation (c). This is reaffirmed in [0035] of Subramaniyan, which

states that “the motion estimation circuit 110 can determine the global motion vector by calculating a difference metric for each of final motion vectors in a previous frame, comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold, and determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold”.).

17. Regarding claim 15,

Subramaniyan discloses:

A system according to claim 14, wherein the video processing means is further arranged in use to:

determine one or more motion estimations representative of the global motion of the frame with respect to a one or more respective preceding or succeeding other frames (Subramaniyan: [0035]; [0026], motion estimation is computed for blocks of image data from a current image frame <u>using one or more previously processed image frames</u>)

determine one or motion estimations respectively representative of the global motion of the one or more other frames with respect to the preceding or succeeding frame (Subramaniyan: [0035]; the motion estimation circuit 110 can <u>determine the global motion vector</u> by using an average of <u>all final motion vectors in a previous frame</u>); and

accumulate the respective motion estimations to give one or more respective overall motion estimations each substantially representative of the global motion of the frame with respect to the preceding or succeeding frame (Subramaniyan: [0035], the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame).

18. Regarding claim 16,

Subramaniyan discloses:

A system according to claim 14, wherein the motion estimation selector means further comprises motion estimation testing means for testing the motion estimations in turn (Subramaniyan: [0035], comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold; [0049], This process continues until one of 3 conditions are met: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B), and providing an indication as to whether the test is passed; and output means arranged in use to output a motion estimation as being representative of the global motion of the frame in dependence on the receipt of an indication that the test was passed from the motion estimation testing means, wherein the motion estimation testing means is further arranged to apply the test in turn to motion estimations once they have been determined, and if the test is passed then no further motion estimations are determined (Subramaniyan: [0035], determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold; [0049], This process

continues until one of 3 conditions are met: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B), and if the test is passed then no further motion estimations are determined (Subramaniyan: [0049], This process continues until one of 3 conditions are met: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B).

19. Regarding claim 17,

Subramaniyan discloses:

A system according to claim 16, wherein the test comprises comparing the motion estimation with a threshold value (Subramaniyan: [0049]-[0050], THRESH4), wherein the test is passed if the parameters of the motion estimation do not exceed the threshold value (Subramaniyan: [0049]-[0050], [0054] The best MV at the end of the second stage is chosen as the best MV for the macroblock; the MV having a MSAD below THRESH4 is chosen as the best MV).

Claim Rejections - 35 USC § 103

20. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

21. Claims 1-4, 6-9, 13 and 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramaniyan et al. (US Patent Application Publication # 2004/0028134 A1) in view of Jinzenji et al. (US Patent # 6,977,664 B1).

22. Regarding claim 1,

Subramaniyan teaches:

A computer-implemented method of global motion estimation between frames of a motion-compensated inter-frame encoded video sequence, the method comprising, for a particular frame:

a) determining, using one or more computer processing systems, a motion estimation representative of the global motion between the particular frame and a first preceding or succeeding frame of the inter-frame encoded video sequence, on the basis of motion vectors directly between the particular frame and the first preceding or succeeding frame (As stated in [0030] of Subramaniyan, the "global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame". Thus Subramaniyan is able to determine a motion estimation representative of the global motion between the particular frame and another frame on the basis of an average of motion vectors therebetween, which satisfies claim limitation (a). This is reaffirmed in [0035] of Subramaniyan, which states that "the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame".);

b) determining, using the one or more computer processing systems, one or more further motion estimations representative of the global motion between the particular frame and the first preceding or succeeding frame at least partially on the basis of motion vectors between the particular frame and one or more preceding or succeeding other frames (As stated in [0034] of Subramaniyan, “further motion vector predictors can be determined based on the result of motion estimation done for the same macroblock, but on a different previously coded frame”. Thus Subramaniyan discloses further motion vector predictors based on a previous frame that is different from the previous frame initially used. Using these further motion vectors predictors in light of how global motion vectors in Subramaniyan are determined, Subramaniyan is capable of determining a further motion estimation representative of the global motion between the particular frame and another frame at least partially on the basis of an average of motion vectors between the particular frame and one or more different other frames, which satisfies limitation (b). This is reaffirmed in [0026] of Subramaniyan, which states that “motion estimation is computed for blocks of image data from a current image frame using one or more previously processed image frames”.); and

c) selecting, using the one or more computer processing systems, one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the particular frame (As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame for which a difference metric was below a certain threshold THRESH1”. Since the final motion

vectors are subject to a difference metric and the final motion vectors are used to form the global motion vector, the global motion vector is subject to a predetermined criterion. By determining global motion in such a manner, global motion is contemporaneously selected upon its determination. Thus Subramaniyan is capable of selecting one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame, which satisfies limitation (c). This is reaffirmed in [0035] of Subramaniyan, which states that “the motion estimation circuit 110 can determine the global motion vector by calculating a difference metric for each of final motion vectors in a previous frame, comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold, and determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold”.);

d) storing or outputting said selected motion estimation (Subramaniyan: [0030]; [0076]; Fig 6: item 620: output of global motion estimation)

Subramaniyan fails to teach:

d) storing or outputting said selected motion estimation for use in registering the image of said particular frame with the image of said first preceding or succeeding frame.

Jinzenji teaches:

d) storing or outputting said selected motion estimation for use in registering the image of said particular frame with the image of said first preceding or succeeding frame (Jinzenji: Fig 3: S1; Fig 4: 1; col 8, line 29 – col 9, line 16: output of global motion for use in frame mapping to a reference coordinate system).

At the time of invention, it would have been obvious to a person having ordinary skill in the art to combine the teachings of Jinzenji with Subramaniyan. Outputting the global motion for use in image registration, as in Jinzenji, would allow for creation of a panoramic image based on the global motion of Subramaniyan, thereby allowing a user to implement an established use for global motion.

23. Regarding claim 2, Subramaniyan in view of Jinzenji teaches:

A method according to claim 1, wherein the determining step b) further comprises the steps of:

e) determining one or more motion estimations representative of the global motion of the frame with respect to one or more respective preceding or succeeding other frames (Subramaniyan: [0035]; [0026], motion estimation is computed for blocks of image data from a current image frame <u>using one or more previously processed image frames</u>);

f) determining one or motion estimations respectively representative of the global motion of the one or more other frames with respect to the first preceding or succeeding frame (Subramaniyan: [0035]; the motion estimation circuit 110 can <u>determine the</u>

global motion vector by using an average of all final motion vectors in a previous frame); and

g) accumulating the respective motion estimations to give one or more respective overall motion estimations each substantially representative of the global motion of the frame with respect to the first preceding or succeeding frame (Subramaniyan: [0035], the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame).

24. Regarding claim 3, Subramaniyan in view of Jinzenji teaches:

A method according to claim 1, wherein the selecting step c) further comprises

testing the motion estimations in turn (Subramaniyan: [0035], comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold; [0049], This process continues until one of 3 conditions are met: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B); and

outputting a motion estimation as being representative of the global motion of the frame if it passes the test, wherein the test is applied in turn to motion estimations once they have been determined (Subramaniyan: [0035], determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold; [0049], This process continues until one of 3 conditions are met: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B), and if the test is passed then no further

motion estimations are determined (Subramaniyan: [0049], This process <u>continues until one of 3 conditions are met</u>: [0050], CONDITION 1: The MSAD is below a threshold THRESH4, given by: THRESH4=A*Q+B).

25. Regarding claim 4, Subramaniyan in view of Jinzenji teaches:

A method according to claim 3, wherein the test comprises

comparing the motion estimation with a threshold value (Subramaniyan: [0049]-[0050], THRESH4), wherein the test is passed if the parameters of the motion estimation do not exceed the threshold value (Subramaniyan: [0049]-[0050], [0054] The <u>best MV</u> at the end of the second stage is <u>chosen as the best MV</u> for the macroblock; the MV having a MSAD below THRESH4 is chosen as the best MV).

26. Regarding claim 6, Subramaniyan in view of Jinzenji teaches:

A method according to claim 1 further comprising generating panoramic images from a motion-compensated inter-frame encoded video sequence, the generating comprising:

for each frame of the sequence, determining the global motion of each frame with respect to the first preceding or succeeding frame using the method of claim 1 (Jinzenji: col 8, line 32-56; global motion is obtained in step 1); and

generating at least one panoramic image representing the frames of the video sequence using the frame global motion estimations thus determined (Jinzenji: col 8, line 32-56; a provisional sprite <panoramic image> is generated).

27. Regarding claim 7, Subramaniyan in view of Jinzenji teaches:

A method according to claim 6, wherein the generating step further comprises:

selecting a particular frame of the sequence as a reference frame, the plane of the reference frame being a reference plane (Jinzenji: col 8, line 32-56; the reference coordinate system which is for the reference frame);

for each frame other than the reference frame, accumulating the frame global motion estimations from each frame back to the reference frame (Jinzenji: col 8, line 32-56; each original image of the arbitrary frames is mapped to a reference coordinate system which is for the reference frame);

warping each frame other than the reference frame onto the reference plane using the accumulated frame global motion estimations to give one or more pixel values for each pixel position in the reference plane (Jinzenji: col 8, line 32-56; frame warping occurs when frames are mapped to the reference coordinate system using global motion so as to insert or overwrite pixels); and

for each pixel position in the reference plane, selecting one of the available pixel values for use as the pixel value in the panoramic image (Jinzenji: col 8, line 32-56; a pixel value of a point is obtained from pixel values which exist in the same point).

28. Regarding claim 8, Subramaniyan in view of Jinzenji teaches:

A method according to claim 7, wherein the selecting step comprises selecting a substantially median pixel value from the available pixel values for use in a background

panoramic image (Jinzenji: col 10, line 8-11; for a plurality of pixels which are mapped to the same coordinates, a median value of the pixels is selected as the value of the coordinates of the provisional sprite).

29. Regarding claim 9, Subramaniyan in view of Jinzenji teaches:

A method according to claim 7, wherein the selecting step comprises selecting a substantially most different pixel value from the available pixel values for use in a foreground panoramic image (Jinzenji: col 8, line 47-51; using a threshold to select the most different pixel).

30. Regarding claim 13, Subramaniyan in view of Jinzenji teaches the computer readable storage medium storing limitations of this claim as discussed above with respect to claim 1 (Subramaniyan: [0085]).

31. Regarding claim 19,

Subramaniyan teaches:

A system for generating panoramic images from a motion-compensated inter- frame encoded video sequence, comprising:

a system for global motion estimation between frames of a motion-compensated inter-frame encoded video sequence (Subramaniyan: [0035]; the motion estimation circuit 110 can <u>determine the global motion vector</u> by using an average of all <u>final motion vectors in a previous frame</u>), the system for global motion estimation comprising:

video processing means arranged in use to:

i) determine a motion estimation representative of the global motion directly between the particular frame and an preceding or succeeding frame of the inter-frame encoded video sequence on the basis of motion vectors therebetween (As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame”. Thus Subramaniyan is able to determine a motion estimation representative of the global motion between the particular frame and another frame on the basis of an average of motion vectors therebetween, which satisfies claim limitation (a). This is reaffirmed in [0035] of Subramaniyan, which states that “the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame”.);

ii) determine one or more further motion estimations representative of the global motion between the particular frame and the preceding or succeeding frame at least partially on the basis of motion vectors between sub-parts of the particular frame and sub- parts of one or more preceding or succeeding other frames (As stated in [0034] of Subramaniyan, “further motion vector predictors can be determined based on the result of motion estimation done for the same macroblock, but on a different previously coded frame”. Thus Subramaniyan discloses further motion vector predictors based on a previous frame that is different from the previous frame initially used. Using these further motion

vectors predictors in light of how global motion vectors in Subramaniyan are determined, Subramaniyan is capable of determining a further motion estimation representative of the global motion between the particular frame and another frame at least partially on the basis of an average of motion vectors between the particular frame and one or more different other frames, which satisfies limitation (b). This is reaffirmed in [0026] of Subramaniyan, which states that “motion estimation is computed for blocks of image data from a current image frame using one or more previously processed image frames”.); and

a motion estimation selector means arranged in use to select one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame (As stated in [0030] of Subramaniyan, the “global motion vector is estimated by the motion estimation circuit 110 as the average of all final motion vectors of the previous frame for which a difference metric was below a certain threshold THRESH1”. Since the final motion vectors are subject to a difference metric and the final motion vectors are used to form the global motion vector, the global motion vector is subject to a predetermined criterion. By determining global motion in such a manner, global motion is contemporaneously selected upon its determination. Thus Subramaniyan is capable of selecting one of the motion estimations which meets at least one predetermined criterion as being representative of the global motion of the frame, which satisfies limitation (c). This is reaffirmed in [0035] of Subramaniyan, which states that “the motion estimation circuit 110 can determine the global motion vector by calculating a difference metric for each of final motion vectors in a previous frame,

comparing the difference metric for each of the final motion vectors in the previous frame with a predetermined threshold, and determining the global motion vector based on the each of the final motion vectors in a previous frame with a difference metric that is below the threshold”.);

and further arranged to provide global motion estimations for each frame (Subramaniyan: [0035]; the motion estimation circuit 110 can determine the global motion vector by using an average of all final motion vectors in a previous frame);

Subramaniyan fails to teach:

panoramic image generating means for generating at least one panoramic image representing the frames of the video sequence using the global motion estimations thus determined.

Jinzenji teaches:

panoramic image generating means for generating at least one panoramic image representing the frames of the video sequence using the global motion estimations thus determined (Jinzenji col 8, line 32-56; a provisional sprite <panoramic image> is generated).

At the time of invention, it would have been obvious to a person having ordinary skill in the art to combine the teachings of Jinzenji with Subramaniyan. Using the panoramic generating means of Jinzenji would allow for creation of a panoramic image

based on the global motion of Subramaniyan, thereby allowing a user to implement an established use for global motion.

32. Regarding claim 20, Subramaniyan in view of Jinzenji teaches:

wherein the panoramic image generating means is further arranged in use to:

select a particular frame of the sequence as a reference frame, the plane of the reference frame thereby being a reference plane (Jinzenji: col 8, line 32-56; the reference coordinate system which is for the reference frame);

for each frame other than the reference frame, accumulate the global motion estimations from each frame back to the reference frame (Jinzenji: col 8, line 32-56; each original image of the arbitrary frames is mapped to a reference coordinate system which is for the reference frame);

warp each frame other than the reference frame onto the reference plane using the accumulated global motion estimations to give one or more pixel values for each pixel in the reference plane (Jinzenji: col 8, line 32-56; frame warping occurs when frames are mapped to the reference coordinate system using global motion so as to insert or overwrite pixels); and

for each pixel position in the reference plane, select one of the available pixel values for use as the pixel value in the panoramic image (Jinzenji: col 8, line 32-56; a pixel value of a point is obtained from pixel values which exist in the same point).

33. Regarding claim 21, Subramaniyan in view of Jinzenji teaches:

wherein the panoramic image generating means is further arranged to select a substantially median pixel value from the available pixel values for use in a background panoramic image (Jinzenji: col 10, line 8-11; for a plurality of pixels which are mapped to the same coordinates, a median value of the pixels is selected as the value of the coordinates of the provisional sprite).

34. Regarding claim 22, Subramaniyan in view of Jinzenji teaches:

wherein the panoramic image generating means is further arranged to select a substantially most different pixel value from the available pixel values for use in a foreground panoramic image (Jinzenji: col 8, line 47-51; using a threshold to select the most different pixel).

35. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Subramaniyan et al. (US Patent Application Publication # 2004/0028134 A1) in view of Lee et al. (US Patent Application Publication # 2003/0103568 A1).

36. Regarding claim 18,

Subramaniyan teaches:

A system according to claim 16 (as shown above),

Subramaniyan fails to teach:

and further comprising motion estimation interpolation means arranged to interpolate between the motion estimations of adjacent frames to give an interpolated motion estimation, in dependence on the motion estimation testing means indicating that the test has been failed by all the motion estimations determined by the video processing means.

Lee teaches:

and further comprising motion estimation interpolation means arranged to interpolate between the motion estimations of adjacent frames to give an interpolated motion estimation, in dependence on the motion estimation testing means indicating that the test has been failed by all the motion estimations determined by the video processing means (Lee: [0061]-[0063]).

At the time of invention, it would have been obvious to a person having ordinary skill in the art to combine the teachings of Lee with Subramaniyan. The teachings of Lee provide for motion compensated interpolation that eliminates blocking artifacts (Lee [0048]), thereby increasing the ability of the Subramaniyan teachings to generate accurate global motion in the presence of blocking artifacts.

37. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Subramaniyan et al. (US Patent Application Publication # 2004/0028134 A1) in view of

Jinzenji et al. (US Patent # 6,977,664 B1) and Lee et al. (US Patent Application Publication # 2003/0103568 A1).

38. Regarding claim 5,

Subramaniyan in view of Jinzenji teaches:

A method according to claim 3 (as shown above),

Subramaniyan in view of Jinzenji teaches fails to teach:

wherein if the test is failed, the method further comprises:

interpolating between the motion estimations of adjacent frames to give an interpolated motion estimation which is then output as the motion estimation representative of the global motion of the frame.

Lee teaches:

wherein if the test is failed, the method further comprises:

interpolating between the motion estimations of adjacent frames to give an interpolated motion estimation which is then output as the motion estimation representative of the global motion of the frame (Lee: [0061]-[0063]).

At the time of invention, it would have been obvious to a person having ordinary skill in the art to combine the teachings of Lee with Subramaniyan in view of Jinzenji. The teachings of Lee provide for motion compensated interpolation that eliminates

blocking artifacts (Lee [0048]), thereby increasing the ability of the Subramaniyan in view of Jinzenji teachings to generate accurate global motion in the presence of blocking artifacts.

39. Claims 10-11 and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramaniyan et al. (US Patent Application Publication # 2004/0028134 A1) in view of Jinzenji et al. (US Patent # 6,977,664 B1) and Szeliski et al. (US Patent # 6,348,918 B1).

40. Regarding claims 10-11,

Subramaniyan in view of Jinzenji teaches:

A method according to claim 7 (as shown above),

Subramaniyan in view of Jinzenji fails to teach:

wherein the selecting step comprises:

calculating the mean pixel value of the available pixel values;

calculating the L1 distance between each available pixel value and the calculated mean pixel value; and

select the pixel value with the median L1 distance for use in a background panoramic image.

select the pixel value with the maximum L1 distance for use in a foreground panoramic image.

Szeliski teaches:

wherein the selecting step comprises:

calculating the mean pixel value of the available pixel values (Szeliski: col 8, line 57-65; taking the mean of the color or intensity values);

calculating the L1 distance between each available pixel value and the calculated mean pixel value (Szeliski: col 8, line 57-65; where the averaging is weighted by the distance of each pixel from the nearest invisible pixel); and

select the pixel value with the median L1 distance for use in a background panoramic image (Szeliski: col 8, line 57-65; using the median technique).

select the pixel value with the maximum L1 distance for use in a foreground panoramic image (Szeliski: col 8, line 57-65; the simplest technique is the median technique, but many others exist. This portion of Szeliski discloses blending specifically for a background image. This portion of Szeliski also discloses blending generally. Instead of using the median technique for blending background pixels, a maximum technique is obvious for blending foreground pixels. This is because foreground pixels are most different from background pixels).

It would have been obvious to a person having ordinary skill in the art to combine the teachings of Szeliski with Subramaniyan in view of Jinzenji. Using the blending technique of Szeliski would smooth out disparities of the panoramic image of

Subramaniyan in view of Jinzenji, thus creating a panoramic image with increased image quality (Szeliski: col 9, line 6-8).

41. Regarding claims 23-24, Subramaniyan in view of Jinzenji teaches the system limitations of this claim as discussed above with respect to claims 10-11.

Conclusion

42. Any inquiry concerning this communication or earlier communications from the examiner should be directed to James Pontius whose telephone number is (571) 270-7687. The examiner can normally be reached on Monday - Thursday, 8 AM - 4 PM est..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Ustaris can be reached on (571) 272-7383. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/James Pontius/
Examiner, Art Unit 2483

/Dave Czekaj/
Primary Examiner, Art Unit 2483